ATBC 2011, Arusha, Tanzania

June 14, 2011

A spatio-temporal degradation index using remote sensing in Congo Basin

Valéry GOND ; Lucas BOURBIER ; Guillaume CORNU ; Stéphane GUITET ; Sophie PITHON ; Alexandre PENNEC ; Christine BROGNOLI ; Sylvie GOURLET-FLEURY

CIRAD
Agricultural Research for Development
Forest ecosystems goods and services
Montpellier, France

ONF
Forest National Office
Cayenne, French Guiana

Introduction

CONTEXT

- IPCC recommends to reduce the CO_2 emissions
- Avoiding forest degradation (REDD+) mechanism is proposed
- It still needs a tool for degradation estimation

OBJECTIVE

To build an indicator of human impact at spatial (country size) and temporal (yearly estimation) scales

HYPOTHESIS

The use of remote sensing could provide an estimation of degradation over large areas and during a long period of observation

Background and definition

Harvesting

Forest human impacts are provoked by logging: roads, tracks, harvest and log yard

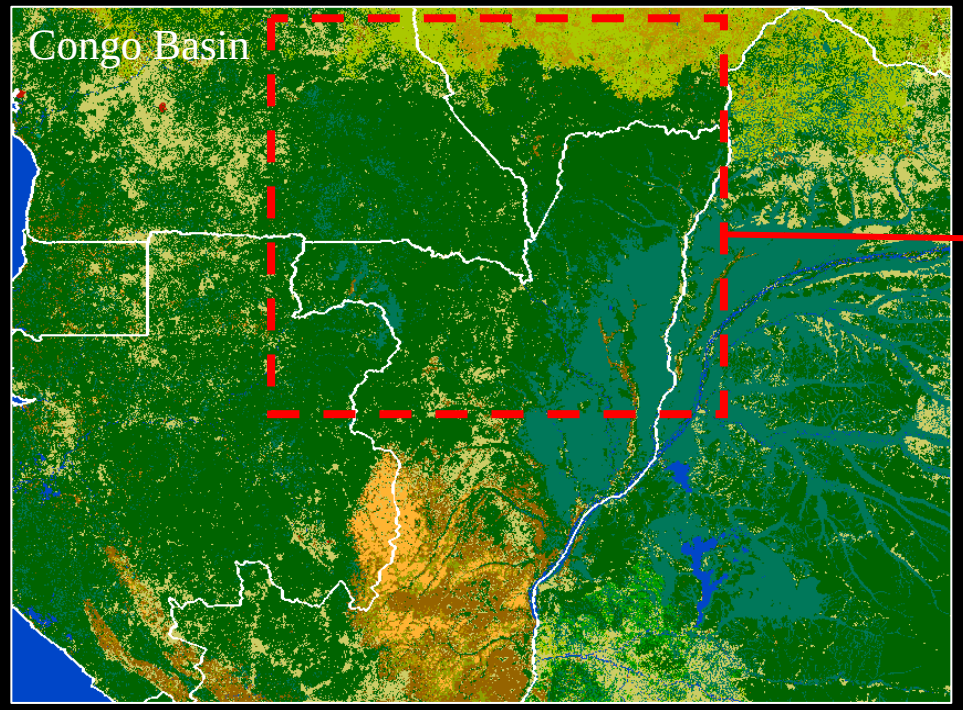
- Biomass reducing
- Changes in forest structure and composition

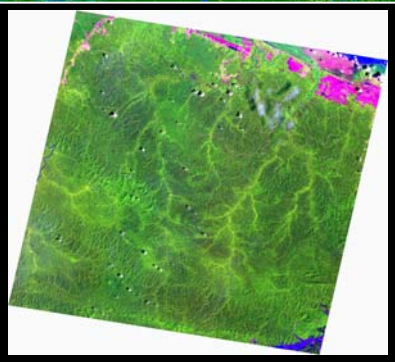
In general impacts are linear element (tracks) and aggregated points (canopy gaps)

Log yard

Tracks and roads

Experimental sites



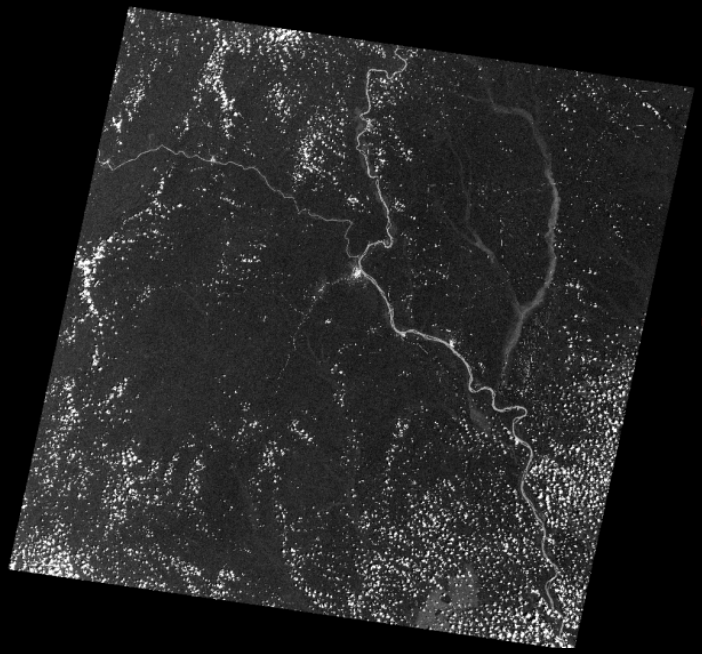


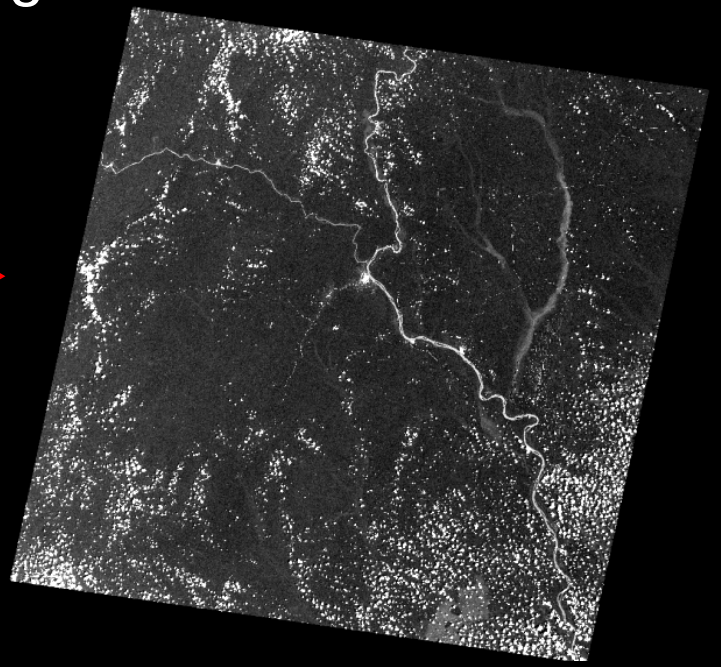
Technique developed with SPOT (10 m spatial resolution) provide information on tracks and canopy gaps

For large areas and for long periods these data are expensive and can not be used routinely

Landsat archives appear to be adequate but the spatial resolution does not allow an accurate characterization of canopy gaps

Pre-processing





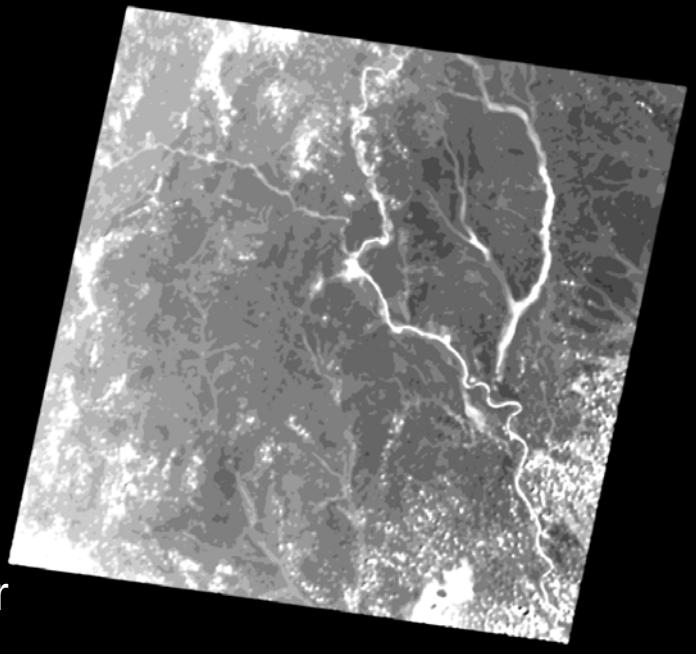
Raw data from USGS-Glovis

Spectral indices processing

NDVI = (NIR – Red) / (NIR + Red)

GR = (Green – Red) / (Green + Red)

NDVI + GR



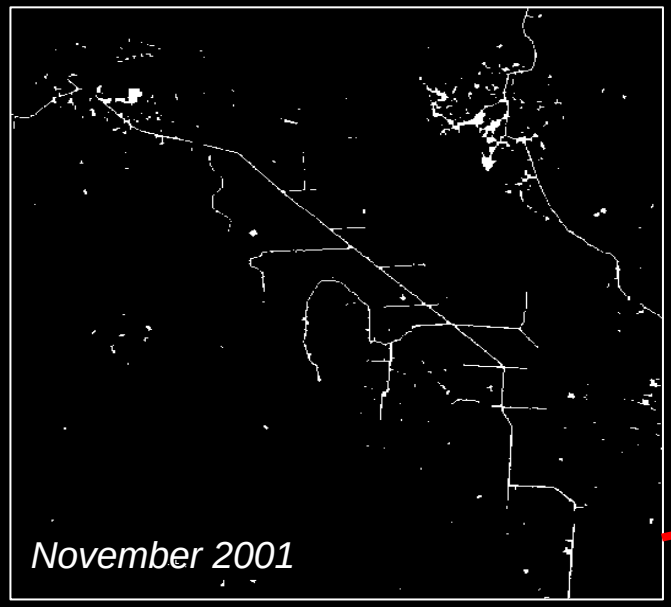
Local contrast improved by the median spatial filter

Processing

Degradation identification
using Red, GR, NDVI+GR channels

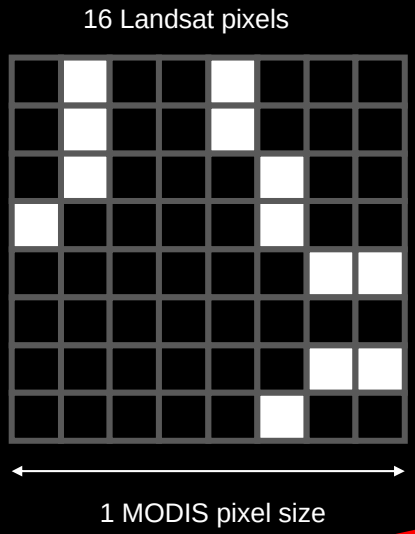
Cloud and water masking
using Blue and SWIR channels

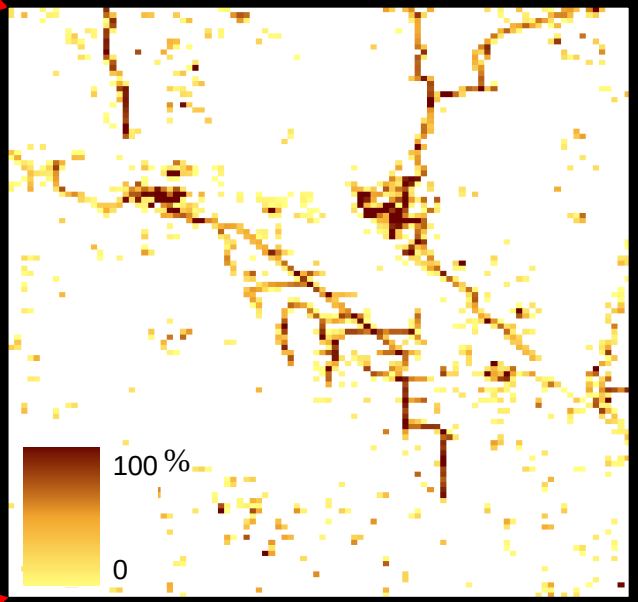
Spatial and temporal processing



A 500m (MODIS pixel) spatial synthesis to estimate the annual degradation intensity

Aggregation



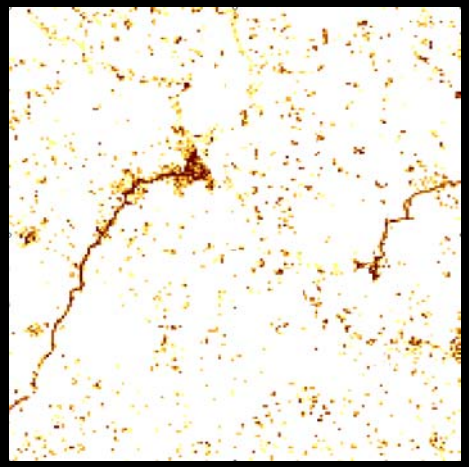


Spatial distribution of the index

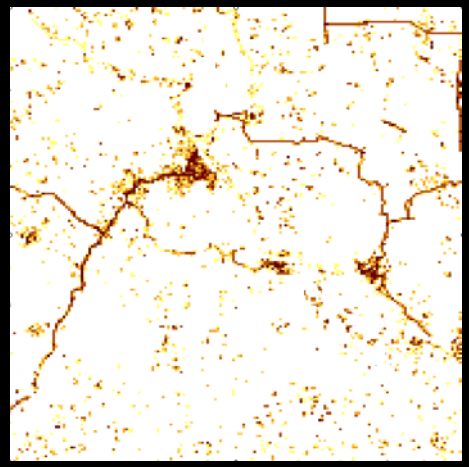
52 Landsat pixels degraded and 204 intact pixels

→ **20.3% forest degradation in 2001**

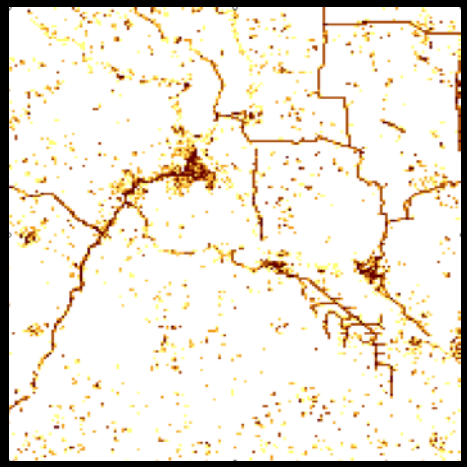
Monitoring tools



1998

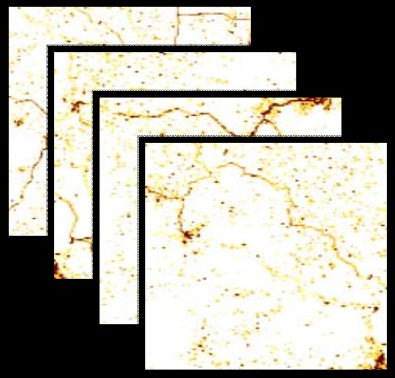


2000

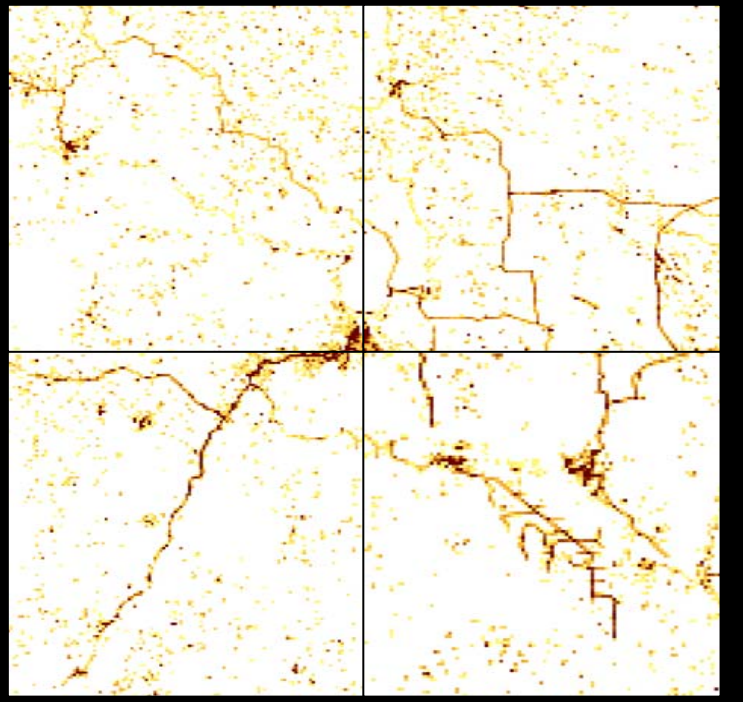


2002

Temporal monitoring



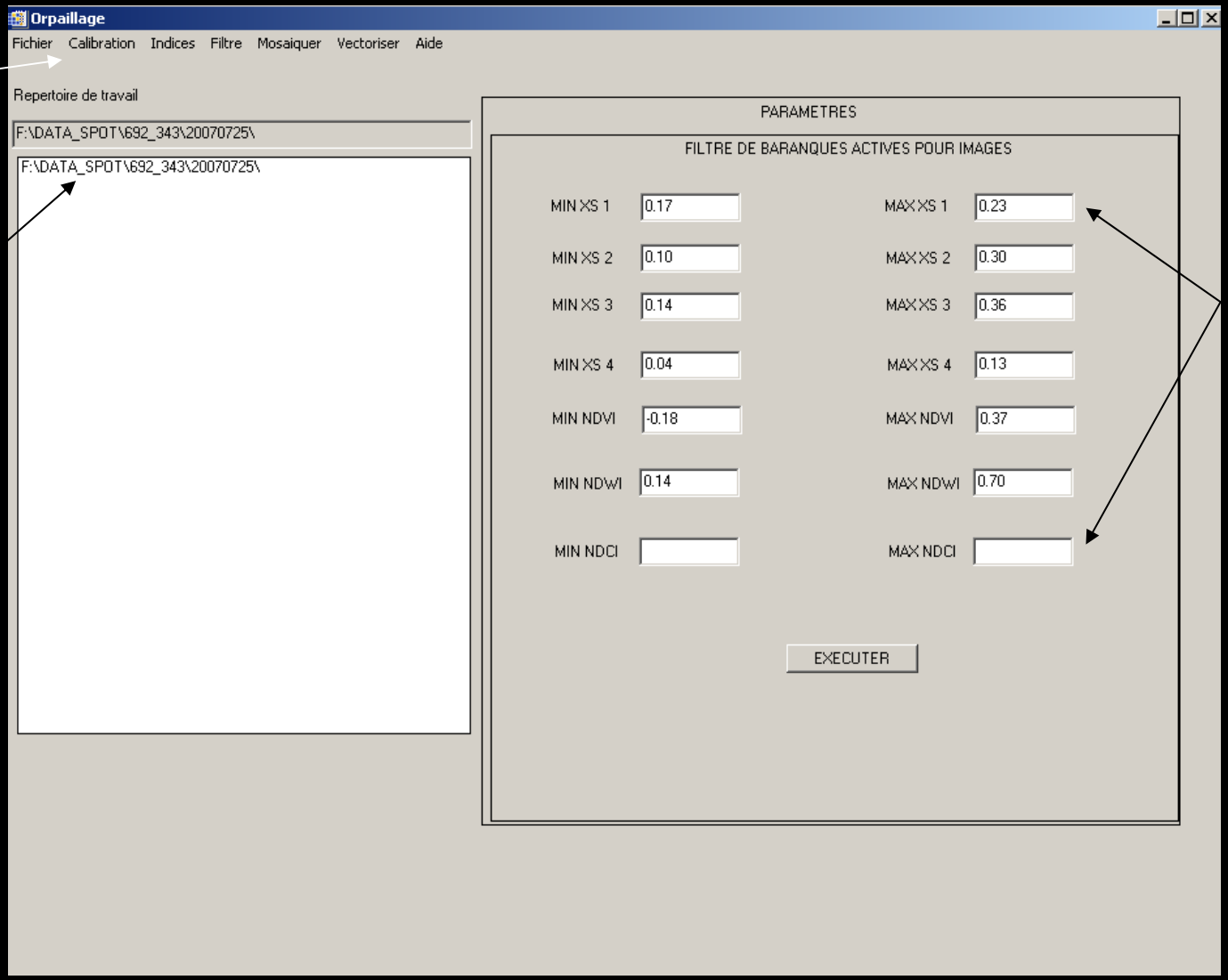
Spatial mosaic



Interface to process archives automatically

Menus

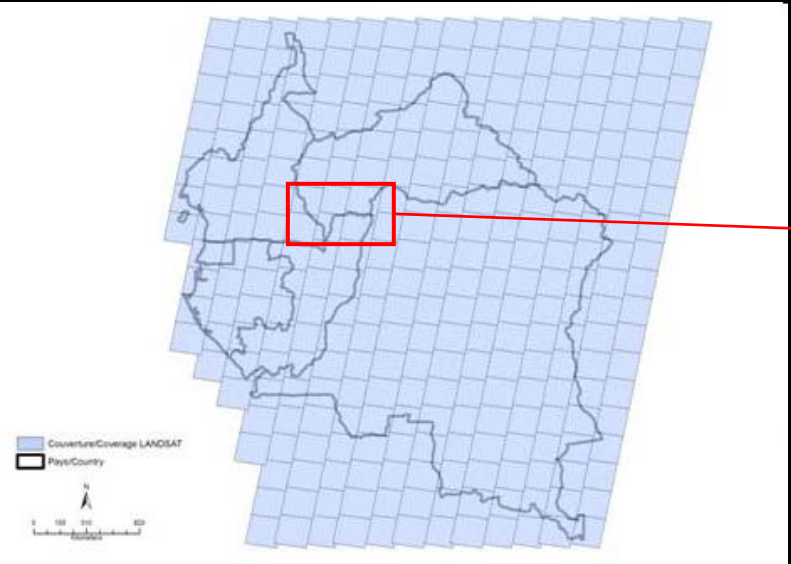
Image data

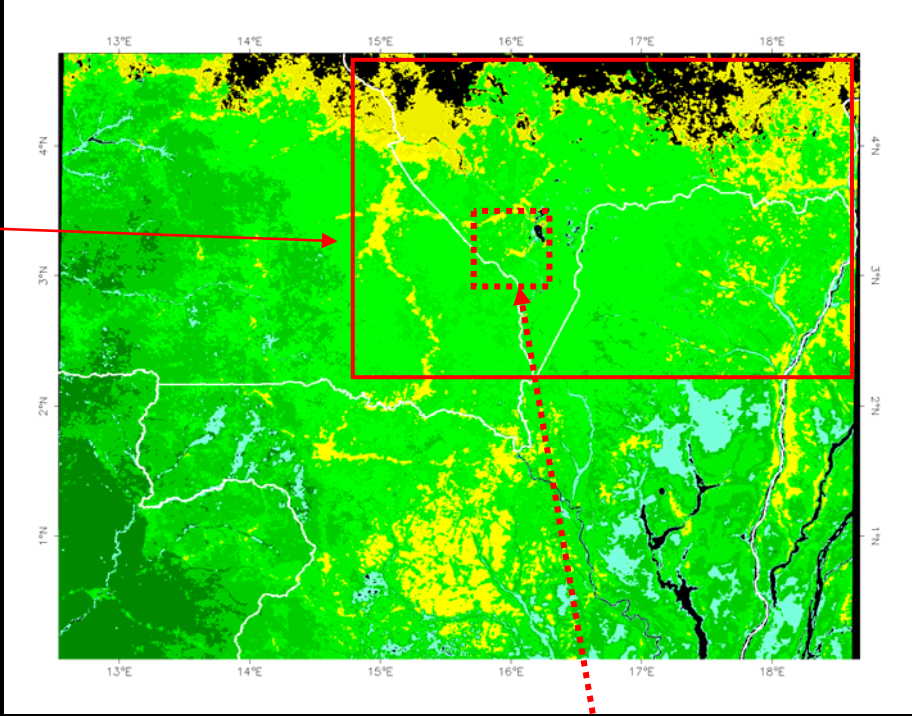


Threshold parameters

Java development

Perspectives





- Evaluate the accuracy of the processing

- 10 years of Landsat archives on moist forest of Centrafrican Republic

- Validation with field data from forest concessions

Conclusion

The tool proposed:

- is useful to estimate forest degradation in space and time
- provides yearly information at country size
- allows ecological studies on forest recovery after impacts
- is a quantitative estimator of degradation to answer to REDD+ needs

Thanks for your attention

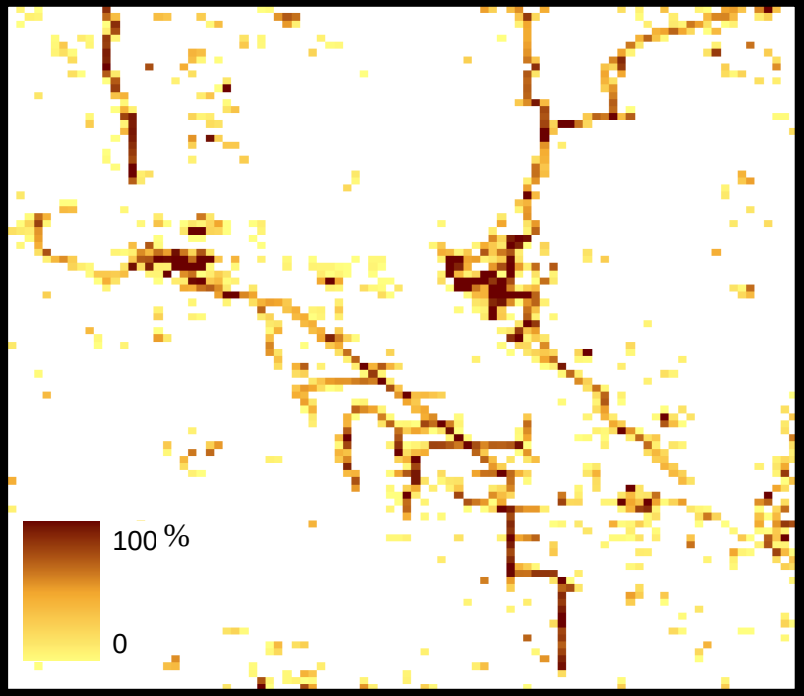
Pithon, S., Jubelin, G., Guitet, S., Gond, V., 2011, A statistical method for detecting logging-related canopy gaps using high resolution optical remote sensing, *International Journal of Remote Sensing*, in press.

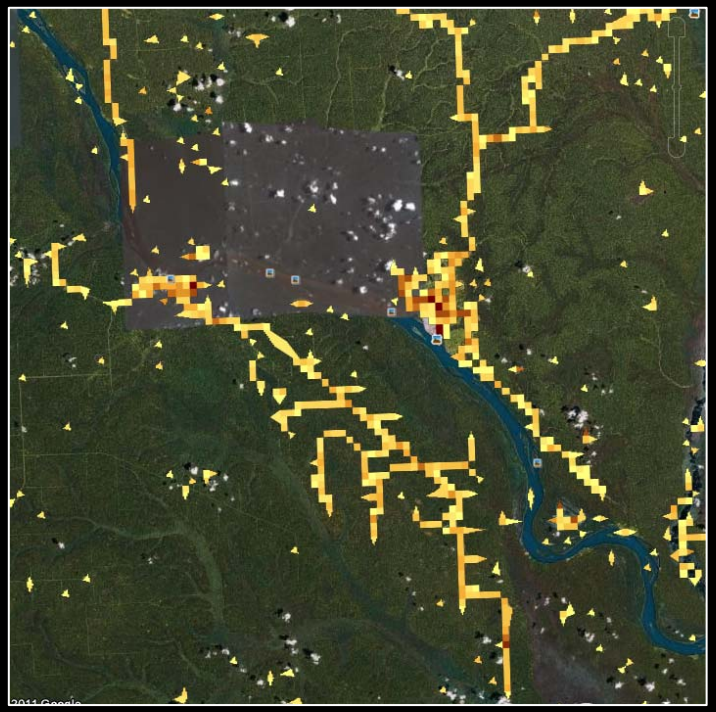
Gond, V., Freycon, V., Molino, J.-F., Brunaux, O., Ingrassia, F., Joubert, P., Pekel, J-F., Prévost, M.F., Thierron, V., Trombe, P-J., Sabatier, D., 2011, Broad scale patterns of forest landscape in Guiana Shield rain forests,
International journal of Applied Earth Observation and Geoinformations, **13**: 357-367.

Pennec, A., Gond, V., Sabatier, D.,
2011, Characterization of tropical forests phenology in French Guiana using MODIS time-series,
Remote Sensing Letters, **2**(4): 337-345.

Briant, G., Gond, V., Laurance, S.,
2010, Habitat fragmentation and the desiccation of forest canopies: A case study from eastern Amazonia,
Biological Conservation, **143**: 2763-2769.

Comparison





Quick validation checking using Google Earth